FAIRCHILD SEMICONDUCTOR®

April 2013

FGH50N3
300 V SMPS IGBT

General Description

Using Fairchild®'s planar technology, this IGBT is ideal for many high voltage switching applications operating at high frequencies where low conduction losses are essential. This device has been optimized for medium frequency switch mode power supplies.

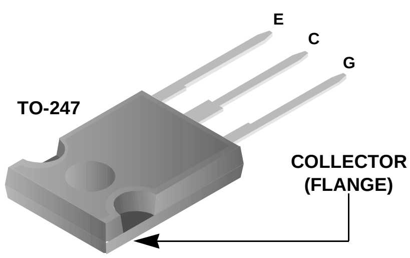
Applications

- SMPS

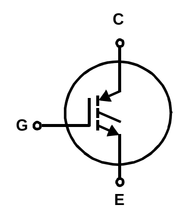
Features

- Low Saturation Voltage: $V_{CE(sat)}$ = 1.4 V max
- Low E_{OFF} = 6.6 uJ/A
- SCWT = 8 us @ = 125℃
- 300V Switching SOA Capability
- Positive Temperature Coefficient above 50 A

Package



Symbol



Device Maximum Ratings T_C= 25°C unless otherwise noted

Symbol	Parameter	Ratings	Unit
BV_{CES}	Collector to Emitter Breakdown Voltage	300	V
I_{C25}	Collector Current Continuous, T_C = 25°C	75	A
I_{C110}	Collector Current Continuous, T_C = 110°C	75	A
I_{CM}	Collector Current Pulsed (Note 1)	240	A
V_{GES}	Gate to Emitter Voltage Continuous	±20	V
V_{GEM}	Gate to Emitter Voltage Pulsed	±30	V
SSOA	Switching Safe Operating Area at T_J = 150°C, Figure 2	150A at 300V	
E_{AS}	Single Pulse Avalanche Energy, I_{CE} = 30A, L = 1.78mH, V_{DD} = 50V	800	mJ
E_{ARV}	Single Pulse Reverse Avalanche Energy, I_{EC} = 30A, L = 1.78mH, V_{DD} = 50V	800	mJ
P_D	Power Dissipation Total T_C = 25°C	463	W
	Power Dissipation Derating T_C > 25°C	3.7	W/°C
T_J	Operating Junction Temperature Range	-55 to 150	°C
T_{STG}	Storage Junction Temperature Range	-55 to 150	°C
t_{SC}	Short Circuit Withstand Time (Note 2)	8	µs

CAUTION: Stresses above those listed in "Device Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:
1. Pulse width limited by maximum junction temperature.
2. $V_{CE(PK)}$ = 180V, T_J = 125°C, V_{GE} = 12Vdc, R_G = 5Ω

Package Marking and Ordering Information

Device Marking	Device	Package	Tape Width	Quantity
FGH50N3	FGH50N3	TO-247	N/A	30

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
Off State Characteristics							
BV_{CES}	Collector to Emitter Breakdown Voltage	I_{CE} = 250µA, V_{GE} = 0V		300V	-	-	V
BV_{ECS}	Emitter to Collector Breakdown Voltage	I_{EC} = 10mA, V_{GE} = 0V		15V	-	-	V
I_{CES}	Collector to Emitter Leakage Current	V_{CE} = 300V	T_J = 25°C	-	-	250	µA
			T_J = 125°C	-	-	2.0	mA
I_{GES}	Gate to Emitter Leakage Current	V_{GE} = ± 20V		-	-	±250	nA
On State Characteristics							
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE}= 30A, V_{GE} = 15V	T_J = 25°C	-	1.30	1.4	V
			T_J = 125°C	-	1.25	1.4	V
Dynamic Characteristics							
$Q_{G(ON)}$	Gate Charge	I_{CE} = 30A, V_{CE} = 150V	V_{GE} = 15V	-	180	-	nC
			V_{GE} = 20V	-	228	-	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	I_{CE} = 250µA, V_{CE} = V_{GE}		4.0	4.8	5.5	V
V_{GEP}	Gate to Emitter Plateau Voltage	I_{CE} = 30A, V_{CE} = 150V		-	7.0	-	V
Switching Characteristics							
SSOA	Switching SOA	T_J = 150°C, R_G = 5Ω, V_{GE} = 15V , L = 25µH, Vce = 300V		150	-	-	A
$t_{d(ON)I}$	Current Turn-On Delay Time	IGBT and Diode at T_J = 25°C, I_{CE} = 30A, V_{CE} = 180V, V_{GE} = 15V, R_G = 5Ω, L = 100µH, Test Circuit - Figure 20		-	20	-	ns
t_{rI}	Current Rise Time			-	15	-	ns
$t_{d(OFF)I}$	Current Turn-Off Delay Time			-	135	-	ns
t_{fI}	Current Fall Time			-	12	-	ns
E_{ON2}	Turn-On Energy (Note 1)			-	130	-	µJ
E_{OFF}	Turn-Off Energy (Note 2)			-	92	120	µJ
$t_{d(ON)I}$	Current Turn-On Delay Time	IGBT and Diode at T_J = 125°C, I_{CE} = 30A, V_{CE} = 180V, V_{GE} = 15V, R_G = 5Ω, L = 100µH, Test Circuit - Figure 20		-	19	-	ns
t_{rI}	Current Rise Time			-	13	-	ns
$t_{d(OFF)I}$	Current Turn-Off Delay Time			-	155	190	ns
t_{fI}	Current Fall Time			-	7	15	ns
E_{ON2}	Turn-On Energy (Note 1)			-	225	270	µJ
E_{OFF}	Turn-Off Energy (Note 2)			-	135	200	µJ
Thermal Characteristics							
$R_{\theta JC}$	Thermal Resistance Junction-Case	TO-247		-	-	0.27	°C/W

NOTE:

1. E_{ON2} is the turn-on loss when a typical diode is used in the test circuit and the diode is at the same T_J as the IGBT. The diode type is specified in figure 20.

2. Turn-Off Energy Loss (E_{OFF}) is defined as the integral of the instantaneous power loss starting at the trailing edge of the input pulse and ending at the point where the collector current equals zero (I_{CE} = 0A). All devices were tested per JEDEC Standard No. 24-1 Method for Measurement of Power Device Turn-Off Switching Loss. This test method produces the true total Turn-Off Energy Loss.

Typical Performance Curves T_J = 25°C unless otherwise noted

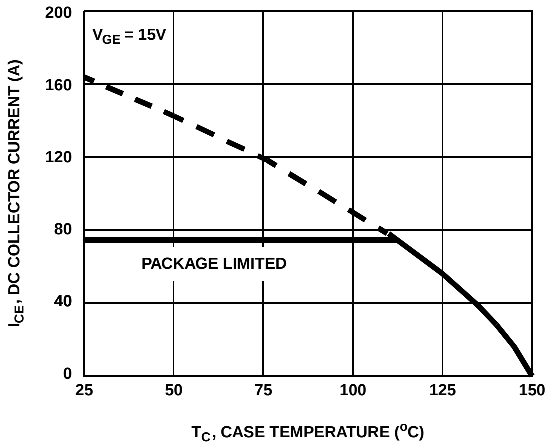


Figure 1. DC Collector Current vs Case Temperature

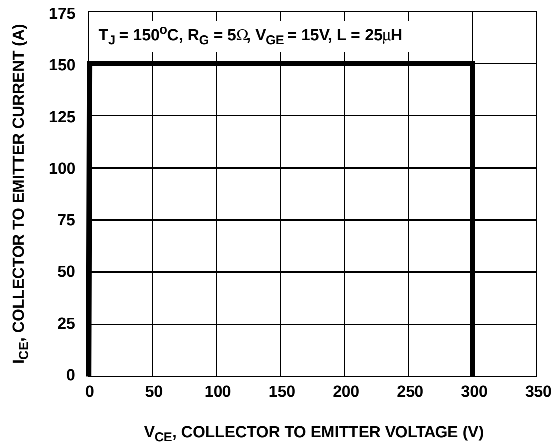


Figure 2. Minimum Switching Safe Operating Area

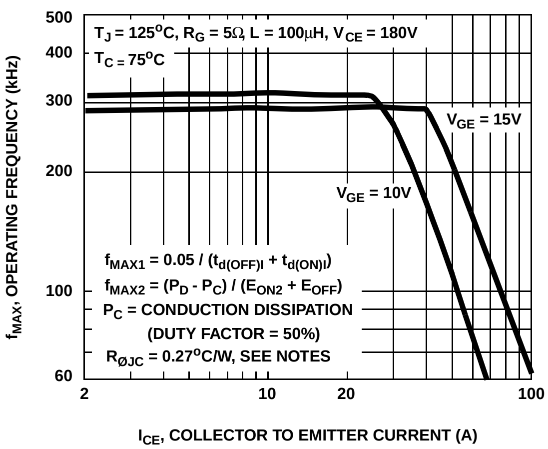


Figure 3. Operating Frequency vs Collector to Emitter Current

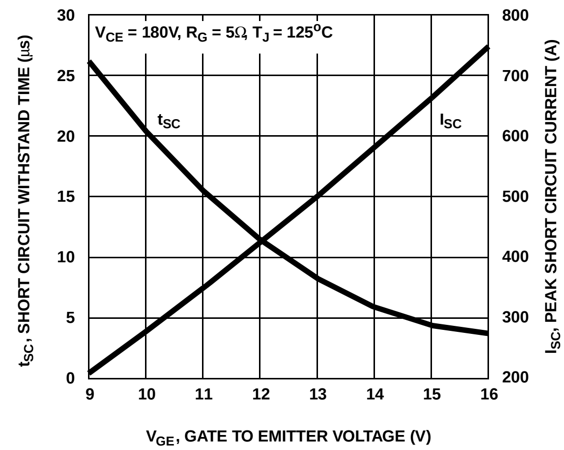


Figure 4. Short Circuit Withstand Time

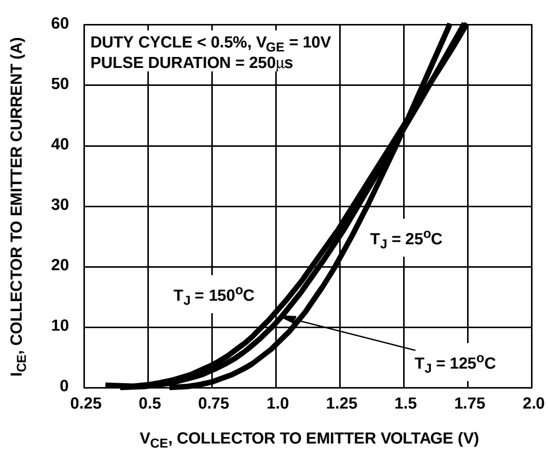


Figure 5. Collector to Emitter On-State Voltage

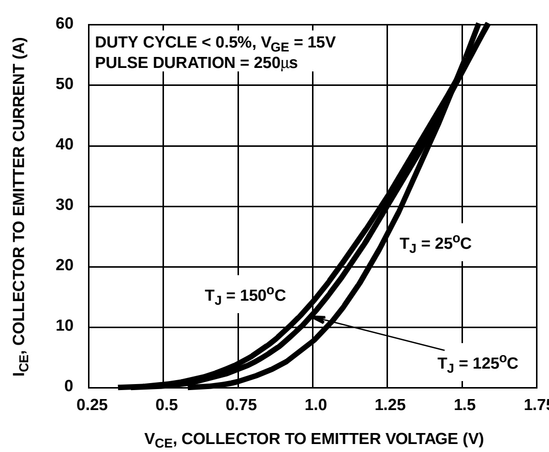


Figure 6. Collector to Emitter On-State Voltage

Typical Performance Curves T_J = 25°C unless otherwise noted (Continued)

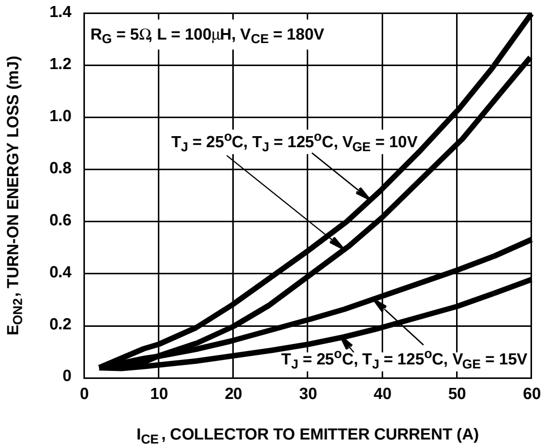


Figure 7. Turn-On Energy Loss vs Collector to Emitter Current

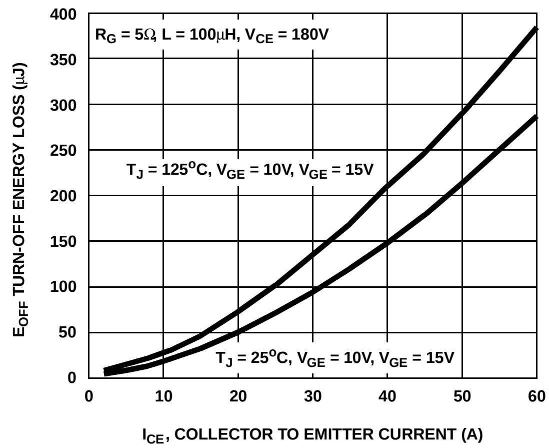


Figure 8. Turn-Off Energy Loss vs Collector to Emitter Current

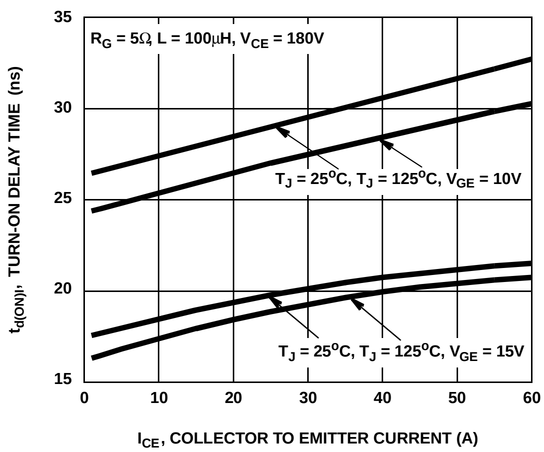


Figure 9. Turn-On Delay Time vs Collector to Emitter Current

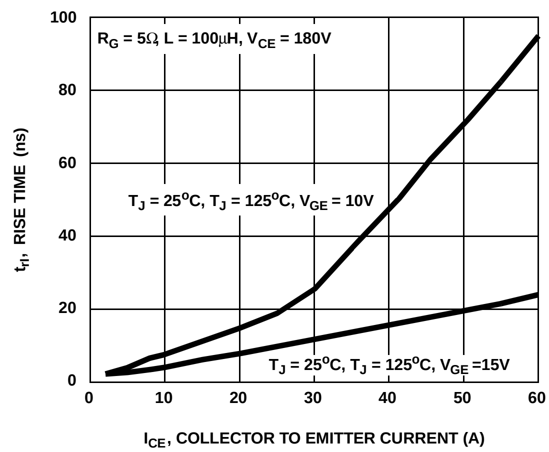


Figure 10. Turn-On Rise Time vs Collector to Emitter Current

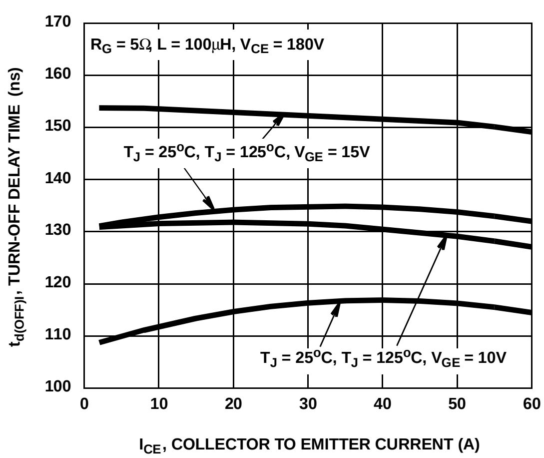


Figure 11. Turn-Off Delay Time vs Collector to Emitter Current

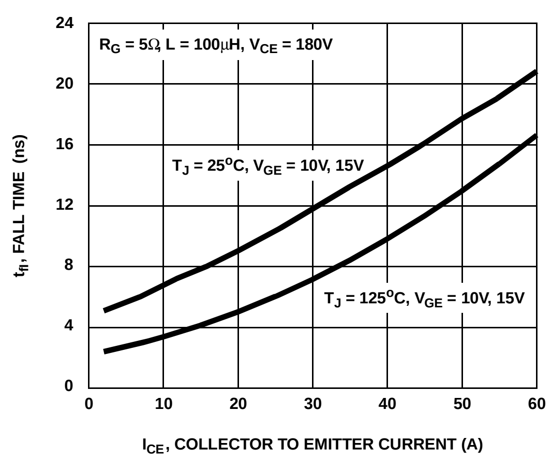


Figure 12. Fall Time vs Collector to Emitter Current

Typical Performance Curves $T_J = 25°C$ unless otherwise noted (Continued)

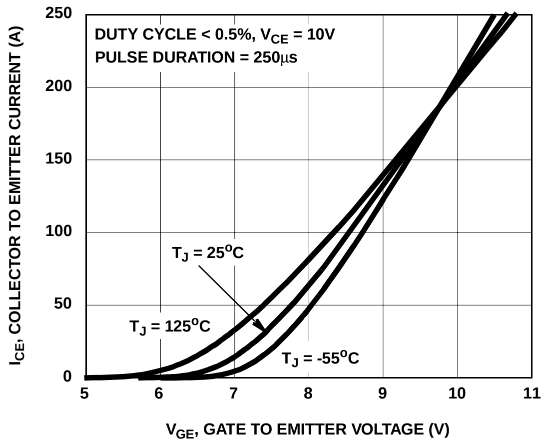


Figure 13. Transfer Characteristic

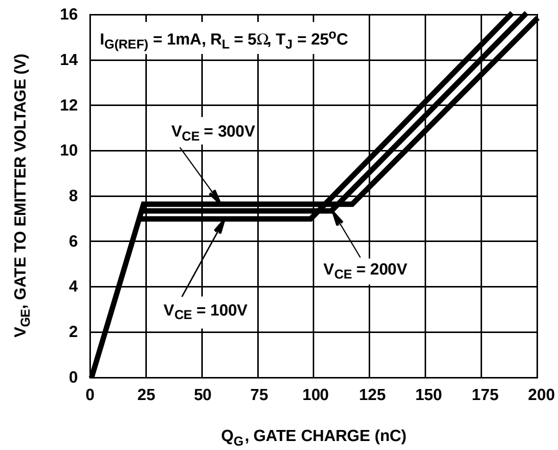


Figure 14. Gate Charge

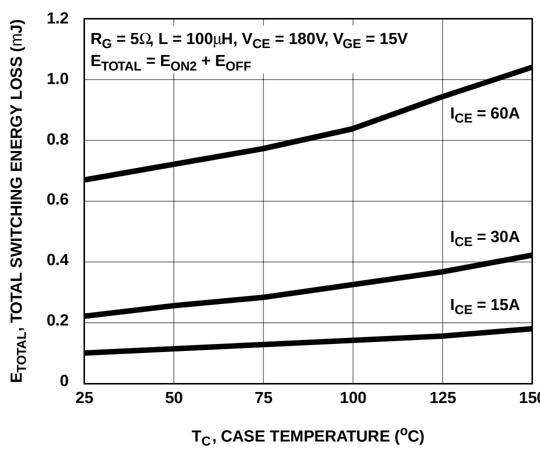


Figure 15. Total Switching Loss vs Case Temperature

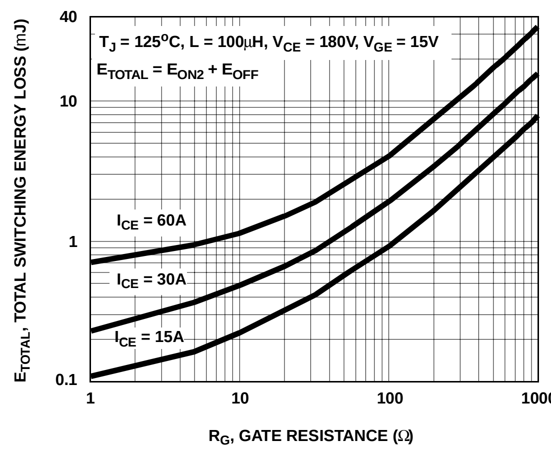


Figure 16. Total Switching Loss vs Gate Resistance

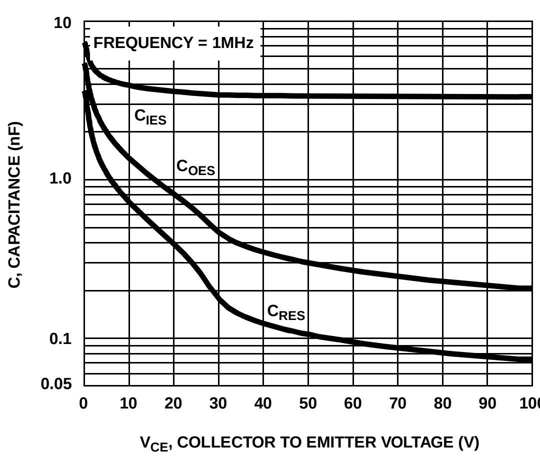


Figure 17. Capacitance vs Collector to Emitter Voltage

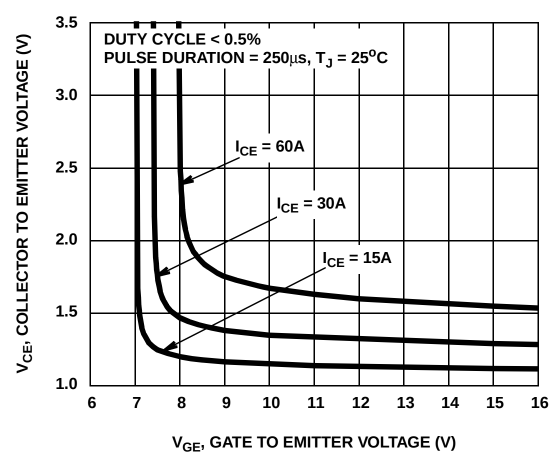


Figure 18. Collector to Emitter On-State Voltage vs Gate to Emitter Voltage

Typical Performance Curves T_J = 25°C unless otherwise noted (Continued)

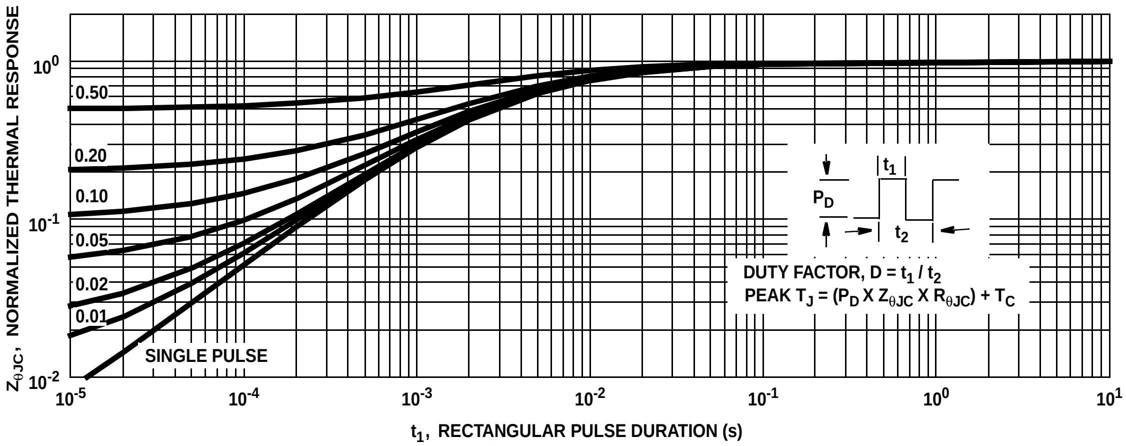


Figure 19. IGBT Normalized Transient Thermal Impedance, Junction to Case

Test Circuit and Waveforms

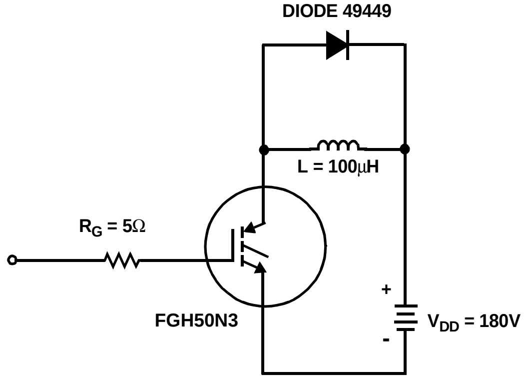


Figure 20. Inductive Switching Test Circuit

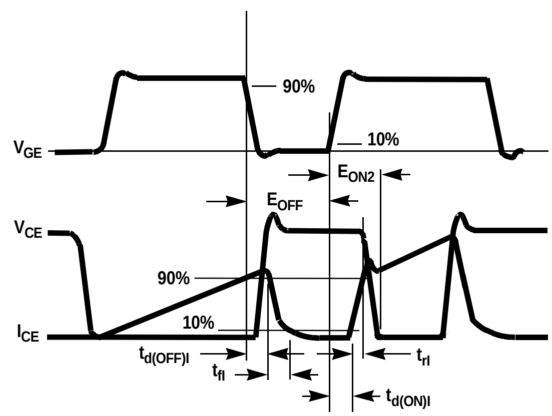
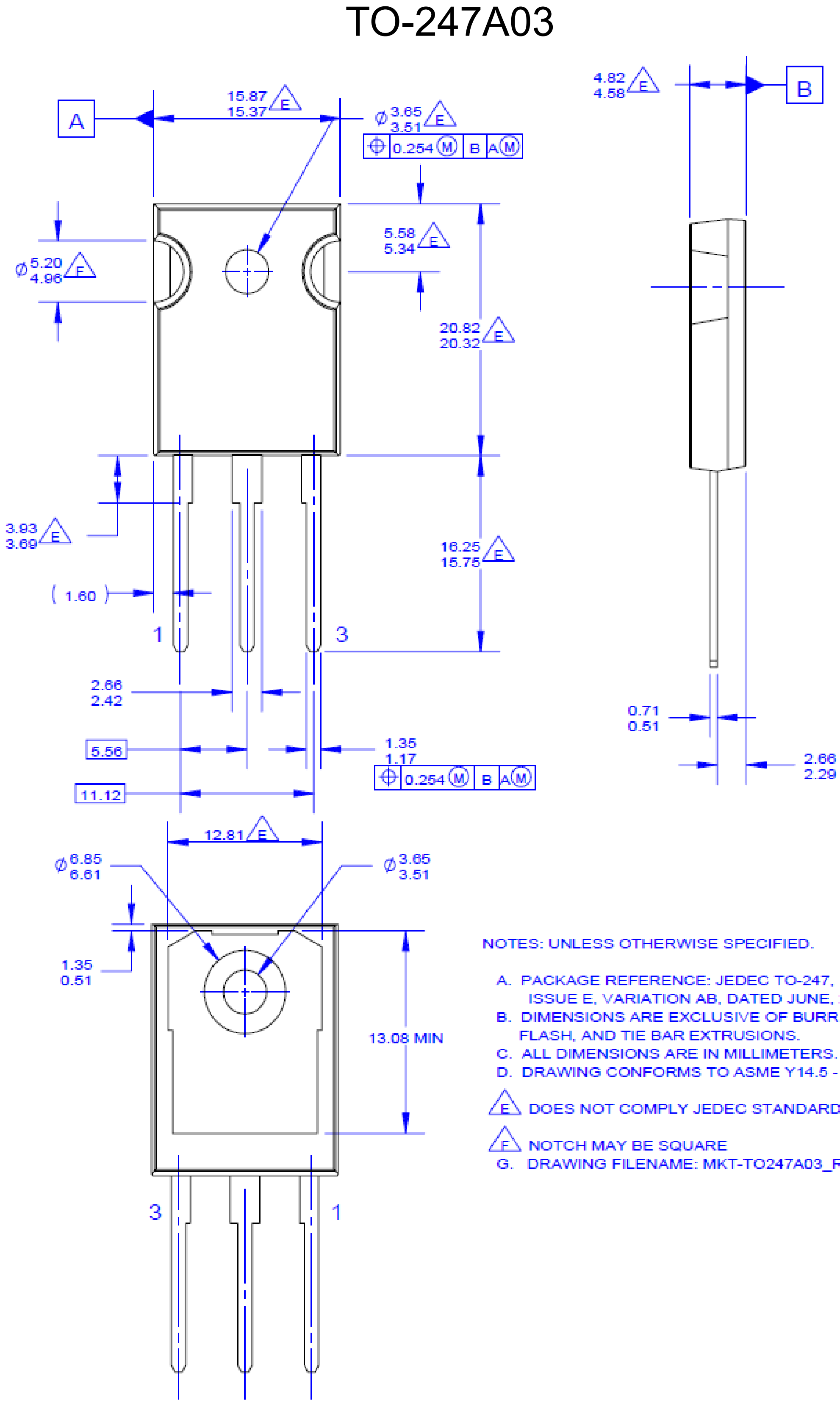


Figure 21. Switching Test Waveforms

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5 - 1994

E. DOES NOT COMPLY JEDEC STANDARD VALUE

F. NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03_REV03

FAIRCHILD SEMICONDUCTOR®

TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

2Cool™
AccuPower™
AX-CAP®*
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficentMax™
ESBC™
®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FPS™
F-PFS™
FRFET®
Global Power Resource℠
Green Bridge™
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Marking Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
mWSaver™
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®
®
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™
SYSTEM GENERAL®*
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC®
TriFault Detect™
TRUECURRENT®*
µSerDes™
SerDes™
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
VoltagePlus™
XS™

*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used here in:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handing and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS
Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I64